FASTIPS
Quick, practical guidance

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Using Spatial Data in Impact Assessment

Assessing impacts means understanding where effects originate, how they spread, and who or what is affected.

Impact assessments (IAs) examine development effects across space and time. These effects may relate to social conditions (e.g., socio-demographics, health) or environmental systems (e.g., water, biodiversity, air, climate). The effects often change in time and space as projects, programs, plans, or policies evolve, and depending on the nature and time lag in the social conditions or the environmental systems, they too may change spatially. This typically involves analyzing spatial relationships between impact sources (e.g., infrastructure, emissions), pathways (e.g., noise propagation, water flows) and receptors (e.g., communities, habitats). Reliable qualitative and quantitative data are, therefore, essential to identify significant impacts, compare alternatives, and design effective mitigation.

Because policies, plans, programs and projects (PPPPs) are inherently location-based, qualitative and quantitative spatial data and spatial analysis tools play a central role in IA. Access to spatial datasets makes it easier for practitioners to combine multiple criteria, examine patterns over time, and strengthen the evidence base of assessments.

What is spatial data and why does it matter for practice?

Spatial (or geospatial, geographic) data describe the location, extent and characteristics of features such as land use, infrastructure, environmental assets, or population groups. For practitioners, spatial data add value by answering practical questions such as: Where are sensitive receptors located? Where do impacts overlap, or accumulate? Which areas are most suitable for development or protection? By adding geographic, location-specific context to non-spatial information, spatial data support clearer analysis, more transparent decisionmaking, and more effective communication of assessment findings (e.g., by maps providing visual insight and overview) to authorities, stakeholders, and the public.

Spatial data sources and management

Practitioners can draw on an expanding range of spatial data from global, national, and local sources, including environmental monitoring programs, planning databases, aerial photography, and administrative records. New data streams from remote sensing (e.g., earth observation satellites, drones), smart technologies (e.g., smart city infrastructure, wearable devices) and even social media (e.g., health perceptions) further expand available evidence.

Most spatial datasets include metadata (i.e., descriptive information that explains their content, origin, scale, quality, and limitations). Reviewing metadata is a critical practical step: it helps determine whether data are fit for use, identify gaps or inconsistencies, and anticipate how limitations may affect assessment results (e.g., dated monitoring records not capturing current status of air/water quality, or gaps in population health data affecting the comprehensiveness and/or accuracy of assessments). This is particularly important during scoping, when data constraints should be identified early and addressed where possible.

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Turning spatial data into practical insights

Using spatial data effectively requires matching data quality, resolution and analysis methods to the scope and scale of the IA. Geographic Information Systems (GIS) is the main tool used in practice to store, analyze, and visualize spatial data.

GIS analysis allows practitioners to overlay datasets, identify spatial overlaps and trends, and support cumulative effects assessment (e.g., by identifying the co-location of multiple pressures or identifying the overall environmental sensitivity of an area based on co-occurring natural assets and their conservation status). Spatial data can also be used to sieve environmental criteria for site suitability (e.g., excluding unsuitable areas for certain development types based on ecosystem service values), or in models to explore future scenarios, test alternatives, and anticipate environmental change. Maps and visual outputs help translate complex analyses into formats that are easier to interpret and discuss with decisionmakers and stakeholders.

Different GIS techniques are useful at different IA stages. For example, thematic maps and basic spatial statistics are often sufficient for scoping and baseline analysis (e.g., to examine patterns in pollution levels, species distribution, or disease outbreak), while multi-criteria analysis or modelling are more appropriate when comparing alternatives (e.g., to determine environmentally sensitive locations or suitable areas for development). Similarly, GIS can be used in public participation and stakeholder consultation processes to both convey and gather information. Public participation GIS has emerged as a collaborative approach to bring expert data and local knowledge together, and thus empower communities in plan making and environmental assessment.

Further reading

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Stieb, D.M., Huang, A., Hocking, R., Crouse, D.L., Osornio-Vargas, A.R., Villeneuve, P.J. (2019). Using maps to communicate environmental exposures and health risks: Review and best-practice recommendations. *Environmental Research*, 176: 108518. doi: 10.1016/j.envres.2019.05.049

FIVE IMPORTANT THINGS TO KNOW

1. **Using spatial data and maps in IA** supports better environmental risk identification and alternatives analysis (e.g., by providing geographical context and identifying pressure-receptor overlaps), improves cost-effectiveness (such as reduced fieldwork and early detection of constraints), and facilitates stakeholder communication.
2. **While PPPP scale should guide data resolution and detail, practitioners often need to work pragmatically with what is available** due to access, licensing or privacy constraints; this introduces uncertainty which needs to be acknowledged openly to ensure credibility.
3. **Strategic assessments typically rely on desktop-based spatial data, while project-level EIAs add site-specific field data;** linking the two by data sharing and data tiering improves overall assessment quality.
4. **There is no single "best" approach to spatial analysis**—methods should be chosen based on assessment objectives, available data, technical capacity, and stakeholder needs.
5. **Stakeholders have different levels of spatial literacy;** tailoring maps and explanations (e.g., on map scale or accuracy of the represented data) improves understanding, engagement, and use of IA results.

FIVE IMPORTANT THINGS TO DO

1. **Agree on a data management plan early on** covering data sources, metadata, quality checks, harmonization, and methods of analysis.
2. **Select spatial datasets in consultation with authorities, stakeholders, and affected communities** to ensure existing datasets or new datasets will address key concerns and IA objectives.
3. **Actively manage data quality by correcting errors** (e.g., relating to scale, time, or attribute records) where possible and clearly documenting limitations and uncertainties in IA reports.
4. **Share and reuse data across assessments and tiers** (from SEA to EIA) to strengthen evidence, improve consistency, and avoid duplication of effort.
5. **Produce clear, accessible maps and spatial outputs tailored to different audiences,** using formats such as printed maps, digital maps, online platforms, or interactive tools.

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Have a suggestion or request for FasTips on a different topic?
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